

**CLAIMS**

We claim:

- 1           1.     A system for removing organic or organometallic materials from an article  
2     comprising:  
3           an enclosed vacuum reaction chamber constructed and arranged to contain an  
4     article having organic or organometallic materials located therein;  
5           said enclosed vacuum reaction chamber containing an oxygen-containing gas,  
6     wherein the vacuum pressure within said enclosed vacuum reaction chamber is between  
7     about 50 mtorr and about 1500 mtorr;  
8           means for emitting vacuum ultraviolet rays having a wavelength of about 172 nm  
9     contained within said enclosed vacuum reaction chamber;  
10          wherein said emitted vacuum ultraviolet rays fragment the hydrocarbon bonds in  
11     said organic or organometallic materials;  
12          wherein said oxygen-containing gas within said enclosed vacuum reaction  
13     chamber and said emitted vacuum ultraviolet rays photochemically react to produce  
14     ozone and activated oxygen; and  
15          wherein said ozone and said activated oxygen react with said fragments of said  
16     organic and organometallic materials.
- 1           2.     The system as defined in Claim 1, wherein said means for emitting  
2     vacuum ultraviolet rays is one or more dielectric barrier discharge lamps.
- 1           3.     The system as defined in Claim 2, wherein said one or more dielectric  
2     barrier discharge lamps contain xenon gas in an excimer state.

1     4.     A system for removing organic and organometallic materials from an article  
2             comprising:

3             a vacuum reaction chamber in which the vacuum pressure is from about 50 mtorr  
4     to 1500 mtorr, said vacuum reaction chamber containing oxygen-containing gas and at  
5     least one article having organic or organometallic materials located thereon;

6             means for emitting vacuum ultraviolet rays having a wavelength of about 172 nm  
7     contained within said vacuum reaction chamber;

8             whereby when said vacuum ultraviolet rays are emitted within said vacuum  
9     reaction chamber the hydrogen bonds in said organic or organometallic materials are  
10    fragmented and oxygen-containing gas is broken down to produce ozone and activated  
11    oxygen; and

12            said ozone and said activated oxygen combine with said fragmented portions of  
13    said organic and organometallic materials.

1            5.     The system as defined in Claim 4, wherein said means for emitting  
2     vacuum ultraviolet rays is one or more dielectric barrier discharge lamps.

1            6.     The system as defined in Claim 5, wherein said one or more dielectric  
2     barrier discharge lamps contain xenon gas in an excimer state.

1           7.     A method for removing organic or organometallic materials from an  
2 article, said method comprising the steps of:

3           creating a vacuum of about 50 mtorr to about 1500 mtorr in an oxygen-containing  
4 gas in a chamber;

5           placing an article containing organic or organometallic materials in said  
6 oxygen-containing gas within said chamber;

7           irradiating said organic or organometallic materials with vacuum ultraviolet rays  
8 having a wavelength of about 172 nm to induce an intermolecular molecule energy  
9 transfer to said organic or organometallic material, whereby said intermolecular molecule  
10 energy transfer results in a cleaving of at least one of the hydrogen bonds within said  
11 organic or organometallic material;

12          irradiating said oxygen-containing gas to create ozone and activated oxygen; and

13          allowing said ozone and said activated oxygen to combine with said cleaved  
14 portions of said organic or organometallic material.

1           8.     The method as defined in Claim 7, wherein said ozone and said activated  
2 oxygen are produced by a photochemical reaction.

1           9.     The method as defined in Claim 7, wherein one or more dielectric barrier  
2 discharge lamps are used to produce said vacuum ultraviolet rays.

1           10.    The method as defined in Claim 9, wherein said one or more dielectric  
2 barrier discharge lamps encapsulate xenon gas in an excimer state.

1           11.    An article from which organic or organometallic materials have been  
2 removed, said article being produced by a process including the steps of:

3           a)    creating a vacuum of about 50 mtorr to about 1500 mtorr in a chamber  
4 containing an oxygen-containing gas;

5           b)    placing an article including the organic or organometallic materials in said  
6 chamber;

7           c)    irradiating said organic or organometallic materials and said  
8 oxygen-containing gas within said chamber with vacuum ultraviolet light rays having a  
9 wavelength of about 172 nm; and

10          d)    removing said organic or organometallic materials from said article  
11 utilizing the ozone and activated oxygen produced in step c).

1           12.    The article as defined in Claim 11, wherein said ozone and said activated  
2 oxygen are produced by a photochemical reaction.

1           13.    The article as defined in Claim 11 wherein said step for irradiating said  
2 oxygen-containing gas utilizes at least one dielectric barrier discharge lamp.

1           14.    The article as defined in Claim 13 wherein said one or more dielectric  
2 barrier discharge lamps contain xenon gas in an excimer state.

1           15. A system for removing the organic or organometallic material from an  
2 article in a dry environment, said system comprising:

3           an enclosed vacuum reaction chamber constructed and arranged to contain an  
4 article having organic or organometallic material on its surface and on its sidewalls;

5           said enclosed vacuum reaction chamber containing an oxygen-containing gas  
6 wherein the vacuum pressure is between about 50 mtorr and about 1500 mtorr;

7           an irradiation device for emitting vacuum ultraviolet rays having a wavelength of  
8 about 172 nm contained within said enclosed vacuum reaction chamber to induce an  
9 intermolecular molecule energy transfer to said organic or organometallic material and to  
10 create ozone and activated oxygen from said oxygen-containing gas; and

11          wherein said ozone and said activated oxygen removes said organic or  
12 organometallic material from said surface and said sidewalls of said article.

1           16. The system as defined in Claim 15 wherein said irradiation device is one  
2 or more dielectric barrier discharge lamps;

1           17. The system as defined in Claim 16 wherein said one or more dielectric  
2 barrier discharge lamps contains xenon gas in an excimer state.

1           18. A method for removing the sidewall polymer and photoresist from an  
2 article, said method comprising the steps of:  
3           creating a vacuum of about 50 mtorr to about 1500 mtorr in a vacuum reaction  
4 chamber;  
5           placing an article having sidewall polymer and photoresist in said vacuum  
6 reaction chamber;  
7           irradiating said vacuum reaction chamber with vacuum ultraviolet light rays  
8 having a wavelength of about 172 nm to produce ozone and activated oxygen for  
9 removing said polymer and photoresist from said article.

1           19. The method as defined in Claim 18 wherein step for irradiating said  
2 vacuum reaction chamber is performed by at least one dielectric barrier discharge lamp.

1           20. The method as defined in Claim 19 wherein said dielectric barrier  
2 discharge lamp includes a xenon gas in an excimer state.

- 1           21.    An apparatus for dissociating molecular bonds in a vacuum comprising:  
2           a dielectric barrier discharge lamp capable of withstanding pressures between  
3           about 50 mtorr and 1500 mtorr.
- 1           22.    An apparatus according to Claim 21 wherein said dielectric barrier  
2           discharge lamp includes a xenon gas in an excimer state.
- 1           23.    An apparatus according to Claim 21 wherein said dielectric barrier  
2           discharge lamp emits wavelengths at approximately 172 nm.